

Energy Systems p81 Text

- 1) ATP-PC System
- 2) Glycolytic System
- 3) Oxidative System



For each System; Using p81 text

Outline

- Aerobic or Anaerobic
- Byproduct Lactic Acid? What is the effect?
- Energy Source?
- Where is it found in the body?
- Limiting Factors
- Time Frame
- Basic Equations
- How Many ATP?
- What sports use system?

Oct 27-8:00 AM

Energy Systems Review

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Oct 19-12:04 PM

Energy systems - ATP-PC

1. Anaerobic
2. There is no byproduct therefore no effect
3. Its energy source is creatine phosphate
4. It is found in the cytoplasm located in the belly of the muscle
5. The limiting factor is the short duration (small storage ATP and Creatine Phosphate)
6. 0- 10-15 seconds
7. $\text{PC} + \text{ADP} \Rightarrow \text{ATP} + \text{creatine}$
8. Advantages of this is quick surges of power
9. The muscle fiber type IIB (fast twitch, glycolytic)
10. Athletes that perform in activities such as weightlifting, sprinting, jumping, etc have this type of energy system.

creatine kinase \uparrow training

Oct 19-12:04 PM

Glycolytic System

- Also known as glycolysis.
- This system is anaerobic, meaning it does not require oxygen to produce.
- Pyruvic Acid is produced as a result of glycolysis, meaning that the pyruvic acid is converted into lactic acid as a byproduct.
- The energy sources include glucose and invested ATP.
- Both the energy produced (ATP) and lactic acid can be found in the muscles of the body. Occurs in cytoplasm.
- The buildup of **lactic acid**, or there isn't sufficient glucose available, are limiting factors such as pain and fatigue; along with the removal period of 1-2 hours of rest activity OR 30-60 minutes of exercise recovery.
- Lasts up to 15-120s
- Advantage: quick surge of power
- The ATP produced gives an athlete 1-3 additional minutes of energy for medium-term activities (200m/800m track events, or a shift in a hockey game).
- $\text{C}_6\text{H}_{12}\text{O}_6 + 2\text{ADP} + 2\text{P}_i \Rightarrow 2\text{C}_3\text{H}_6\text{O}_3 + 2\text{ATP} + 2\text{H}_2\text{O}$
- a net yield of 2 ATP
- muscle fibre type IIA (fast twitch)

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The Oxidative System

The oxidative system is aerobic.

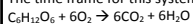
Lactic acid is not a byproduct of this system, rather water and carbon dioxide is the byproduct.

Energy source is fats, glycogen, and proteins and is processed in the mitochondria.

The limited factors is that it's slow (ie it takes time to activate)

Conditioning

The time frame for this system is 120 seconds and beyond.



36 ATP will be produced

Step 1: Glycolysis

One glucose is enzyme mediated into fructose diphosphate, then enzyme mediated into 2 pyruvates. 2 ATP were produced in this step, and two co-enzymes were loaded with hydrogen. Pyruvates are transferred to a separate step, which are then converted into Acetyl CoA

Step 2: Krebs Cycle

The acetyl Co-A is enzyme mediated a number of times (8), two ATP are produced, and a number of co-enzymes are loaded with hydrogen, to be transported to step 3.

Step 3: ETC (electron transport chain)

The co-enzymes reappear with the H atoms, which go through a lengthy process.

In the end, 32 ATP are produced, as well as CO_2 and H_2O

Step 1 - 2 ATP

Step 2 - 2 ATP

Step 3 - 32 ATP

Athletes affected are Cyclists, Canoeist Orienteer, Marathon Runners

Oct 19-12:05 PM

Energy System- Oxidative

Type: Aerobic

By Product: no lactic acid ($\text{CO}_2 + \text{H}_2\text{O}$)

Source: Glycogen, fats and proteins

Where?: Mitochondria

Limiting Factors: Slow, requires lots of oxygen

Time: 120 seconds and beyond

Equations: $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 36\text{ATP} + 36\text{P}_i \Rightarrow 6\text{CO}_2 + 36\text{ATP} + 6\text{H}_2\text{O}$

of ATP: 36/ glucose molecule

Advantageous in endurance-type activities such as marathons, complete soccer games, etc.

Eva, Chantal and Shannon

Oct 19-12:04 PM

Fuel Sources for Oxidative Phosphorylation

Carbohydrates, Fats and Proteins all are converted to Acetyl CoA through various processes and enter the Krebs Cycle to be used for energy

- Glucose (sugars) and Glycogen (carbohydrates) enter via Glycolysis
- Fats enter via Lipolysis
- Proteins enter via Glucogenesis and Lipogenesis

Stored Energy - Fuel Breakdown

Fats	9kcal/g
Carbohydrates	4kcal/g
Protein	4kcal/g

Although fats provide more kilocalories of energy per gram than carbohydrates, fat oxidation requires more oxygen than carbohydrate oxidation and is therefore less efficient.

- Fat provides 5.6 ATP molecules per molecule of O_2
- Carbohydrates provide 6.3 ATP molecules per molecule of O_2

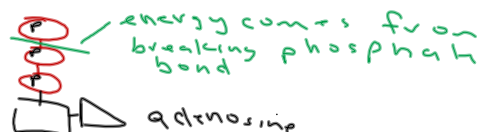
Therefore Carbohydrates are the preferred Fuel source for high-intensity long duration exercise

Oct 27-8:07 AM

Oct 27-10:25 AM

ATP-CP

ATP-CP
Found in muscle fibres.
Aerobic No oxygen
Just Creatine Builds up muscle
10-15 seconds Not enough creatine-phosphate



Oct 28-2:11 PM

^{30-40 V_{O2}}
EPOC - relieve LA
- ↓ HR & ventilation
- thermoregulate
- replenish CP stores

Oct 16-1:54 PM



Jan 20-1:29 PM

V_{O2} Lab

30-40 average female
40-50 average male
L/min → bring in O_2 and metabolize

Jan 20-1:33 PM